

**REMARKS/ARGUMENTS**

Claims 1-6, 9, 10, and 44-62 are pending, and are not currently amended.

**Rejections Under 35 U.S.C. § 103(a)**

Claims 1-6, 9, 10, 44-50, 53-57, and 62 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Felts et al. (USP 4,888,199) in view of Batey et al. and Lee (USP 5,286,581). Claim 51 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Felts et al. and Batey et al. and Lee, in view of Felts et al. (USP 5,364,665). Claims 52, 58, and 59 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Felts et al., Batey et al., and Lee, in view of Collins et al. (USP 5,300,460). Claims 60 and 61 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Batey et al. in view of Lee.

Applicants respectfully submit that independent claims 1, 44, 53, and 54 are patentable over the cited references because, for instance, they do not teach or suggest a computer readable program code for controlling the gas delivery system to operate for a specified time period and for causing a layer to be formed to a thickness which is an odd multiple, greater than one, of a wavelength of light to be used in a subsequent process operation on the layer.

The Examiner cites Lee for allegedly disclosing that a first reflection from an interface between the photoresist layer and the antireflective layer of an exposure light is an odd number, but it is not an odd multiple, greater than one, of the wavelength of light to be used in a subsequent process operation on the layer. Lee merely discloses a 180 degrees shift. Nothing in Lee teaches or suggests a thickness that is an odd multiple, greater than one, of the wavelength.

The specification at page 10, line 14, to page 11, line 14, describes a number of advantages of using thicker antireflective layers by selecting a thickness that is an odd multiple, greater than one, of a wavelength of light to be used in a subsequent process operation on the layer. For instance, the increased thickness achieves improved film consistency from wafer to wafer; provides better control of the refractive index, absorptive index, and thickness of the film; and renders the film suitable for use as a hard mask during an etching step. These are not disclosed or suggested in Lee.

The Examiner alleges that it would have been obvious to realize that odd multiples of the radians as disclosed in Lee would have the same phase angle. Assuming that were the case, there would be no reason to use odd multiples of greater than one since the same phase angle would be present. There is no suggestion to use such odd multiples of greater than one. It is the inventors, not the cited references, that disclosed the reasons for using the odd multiples of greater than one (e.g., to achieve improved film consistency from wafer to wafer; provide better control of the refractive index, absorptive index, and thickness of the film; and render the film suitable for use as a hard mask during an etching step).

For at least the foregoing reasons, independent claims 1, 44, 53, and 54 and dependent claims 2-6, 9, 10, and 45-52 are patentable.

Applicants respectfully assert that independent claims 55, 57, and 62 are patentable over the cited references because, for instance, they do not teach or suggest means for causing the layer to be formed to a thickness which is an odd multiple, greater than one, of a wavelength of light to be used in a subsequent process operation on the thin film.

As discussed above, it is the inventors, not the cited references, that disclosed the use of odd multiples of greater than one, for instance, to achieve improved film consistency from wafer to wafer; provide better control of the refractive index, absorptive index, and thickness of the film; and render the film suitable for use as a hard mask during an etching step. None of the references provide the motivation to use odd multiples of greater than one.

For at least the foregoing reasons, independent claims 55, 57, and 62 and dependent claims 56, 58 and 59 are patentable.

Applicants respectfully submit that claim 60 is patentable over the cited references because, for instance, they do not teach or suggest means for forming a layer of photoresist on the antireflective layer, the antireflective layer having a thickness and refractive indices such that a first reflection from an interface between the photoresist and the antireflective layer of an exposure light will be an odd number which is at least 3 multiplied by  $180^\circ$  out of phase with a second reflection from an interface between the antireflective layer and the substrate layer of the exposure light. Applicants further submit that claim 61 is patentable over

the cited references because, for instance, they do not disclose or suggest means for forming a photoresist pattern by exposing the photoresist layer to an exposure light having a wavelength of 365 nm or less and developing the exposed photoresist layer, wherein a phase shift of an odd multiple of at least 3 multiplied by  $180^\circ$  exists between a first reflection of the exposure light from an interface between the photoresist layer and the antireflective layer and a second reflection of the exposure light from an interface between the antireflective layer and the first layer, the first reflection having almost the same intensity as the second reflection to thereby substantially cancel the first and second reflections.

The Examiner cites Lee for allegedly disclosing that a first reflection from an interface between the photoresist layer and the antireflective layer of an exposure light is an odd number, but it is not at least 3 multiplied by  $180^\circ$  ( $\pi$  in radians) out of phase with a second reflection from an interface between the antireflective layer and the substrate layer of the exposure light. As discussed above, nothing in the references provides the motivation to use an odd number of at least 3. Accordingly, claims 60 and 61 are patentable.

Response to Examiner's Arguments

In response to the arguments, the Examiner alleges that "Lee clearly teaches Applicant's claimed distance as being a multiple, less than one, of the wavelength of light," and that "as such, it is accepted that one of ordinary skill in the art at the time the invention was made would have found it obvious to optimize the operation of the claimed apparatus to achieve the claimed distance."

The Examiner's allegation is baseless. It is unfathomable how Lee's teaching would suggest a layer to be formed to a thickness which is an odd multiple, greater than one, of a wavelength of light to be used in a subsequent process operation on the layer. The Examiner alleges that it would have been obvious to optimize the operation of the claimed invention as discussed in Lee at column 3, line 62, to column 4, line 27. Lee states: "Optimization of the thickness of phase-shift layer 12 is discussed in FIG. 2." Column 3, lines 62-64. The optimization disclosed in Lee is "to optimize the phase shift desired from phase-shift mask 10 to obtain a 180 degrees shift between areas 12' and 13' that are phase shifted and areas 17 that are

not phase shifted" (col. 5, lines 5-8). The 180 degree phase shift is the optimization taught in Lee. Lee is completely devoid of any suggestion of a layer to be formed to a thickness which is an odd multiple, greater than one, of a wavelength of light to be used in a subsequent process operation on the layer. The claimed invention is not mere optimization of a known process.

In addition, the Examiner alleges that Applicants argue that the cited references do not teach light exposure at wavelengths of 365 nm or less. The Examiner's allegation is false. Instead, Applicants contend that claim 61 is patentable over the cited references because, for instance, they do not disclose or suggest means for forming a photoresist pattern by exposing the photoresist layer to an exposure light having a wavelength of 365 nm or less and developing the exposed photoresist layer, wherein a phase shift of an odd multiple of at least 3 multiplied by  $180^\circ$  exists between a first reflection of the exposure light from an interface between the photoresist layer and the antireflective layer and a second reflection of the exposure light from an interface between the antireflective layer and the first layer, the first reflection having almost the same intensity as the second reflection to thereby substantially cancel the first and second reflections. That is, Lee and the other references do not disclose or suggest the recited features, not merely light exposure at wavelengths of 365 nm or less.

Lastly, the Examiner alleges that Applicants argue that the references fail to show certain features of the claimed invention, but those features relied upon are not cited in the rejected claims (i.e., "the first reflection having almost the same intensity as the second reflection to thereby substantially cancel the first and second reflection"). Again, the Examiner's allegation is false. The argued feature is recited in claim 61.

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Examining Group

PATENT

**CONCLUSION**

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance and an action to that end is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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